SHORTER ARTICLES AND DISCUSSION

SELECTION, SUGAR-BEETS AND THRIPS

A DISCOVERY of great importance to students of genetics has recently been made by one of the plant-breeders[1] of the U. S. Department of Agriculture, viz., that beets are regularly cross-pollinated and that an important agent in the process is a minute inconspicuous insect, so small that it readily passes "through the meshes of fine silk chiffon."

To understand fully the theoretical importance of this discovery one need only recall the large attention given to the sugar-beet in recent adverse criticisms of the selection-theory. De Vries in his "Mutationstheorie," p. 72, cites the case of the sugar-beet as showing the most systematic, refined and elaborate selection known for any cultivated plant, and yet as being without any permanent effect in raising the sugar content of the beet. For, although the average sugar content of the beet has by systematic selection been practically doubled in the last 60 years, De Vries holds the improved racial condition to be unstable and thinks that the improved race would within a few generations revert to its old level of sugar-content if the selection were discontinued. His reason for thinking so is the familiar fact that the offspring of the *best* selected beets are on the average not quite so good as their selected mother-beets, but show a tendency to regress downward toward the old level of sugar content. It should be pointed out, however, that in reality regression is not toward the *original* average of 7 or 8 per cent. sugar-content, but toward an average twice as high as this. For De Vries's variation polygon (*l. c.*, Fig. 22) for the sugar content of 40,000 beets shows a nearly symmetrical probability curve about a mode at 15.5 per cent. It is to be supposed therefore that regression would occur *toward this* condition from both the upper and the lower halves of the frequency polygon, rather than toward the old average condition of 7–8 per cent., which, according to the data of DeVries, is now rarely if ever seen in the improved race. To have doubled the average sugar-content of the beet is certainly something of an achievement for selection; the form of

[1] Shaw, Harry B., "Thrips as Pollinators of Beet Flowers," Bull. No. 104, U. S. Dept. Agr., July 10, 1914.

the variation polygon indicates that the change is permanent, so far as ordinary racial characters have permanency.

But why, it may be asked, has selection not achieved *more* in this case? Why should the descendants of, say, a 25 per cent. beet not score better than this? There are probably several reasons why. (1) Physiological reasons probably offer obstacles. A beet can not be formed which is *all* sugar. There has to be present in the beet a machinery for *manufacturing* the sugar. Perhaps 25 per cent. is an impossibly high average for a race of beets. (2) Perhaps the exceptional 25-per-cent. beet owes its extra sweetness in part to environmental causes which are not permanent. In that case the extra sweetness is "somatic rather than germinal," as we should say in the case of an animal.

(3) Finally the discovery that beets are never self-fertilized, but in every generation are cross fertilized, explains why improvement of the beet through selection is so slow and tedious a process. What progress could the animal breeder expect to make if he were able to select only the dams, but never the sires, for his flocks? This is the condition which confronts the plant breeder in attempting to improve the sugar beet. The animal breeder is often chided with the small numbers which his experiments yield as compared with the enormous numbers which an experiment with plants may produce, but the animal breeder has at least this satisfaction that when the animals are securely penned there need be no uncertainty about pedigrees.

The careful observations of Shaw show that thrips, so common in the blossoms of plants and yet so minute as easily to escape notice and to penetrate within silk nets and under paper bags, may be a cause of unsuspected cross-pollination and unaccountable "mutation" in the breeding of cereals and other plants.

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A NOTE ON MULTIPLE ALLELOMORPHS IN MICE

PROFESSOR T. H. MORGAN has recently published in this journal the results of some of his experiments on color inheritance in mice. In this paper he offers material which he considers "evidence establishing" a series of multiple allelomorphs. His series consist at present of four forms, "yellow, gray white-belly, gray